

# RAYTHEON COMPUTER

## DIFFERENTIAL MULTIVERTER

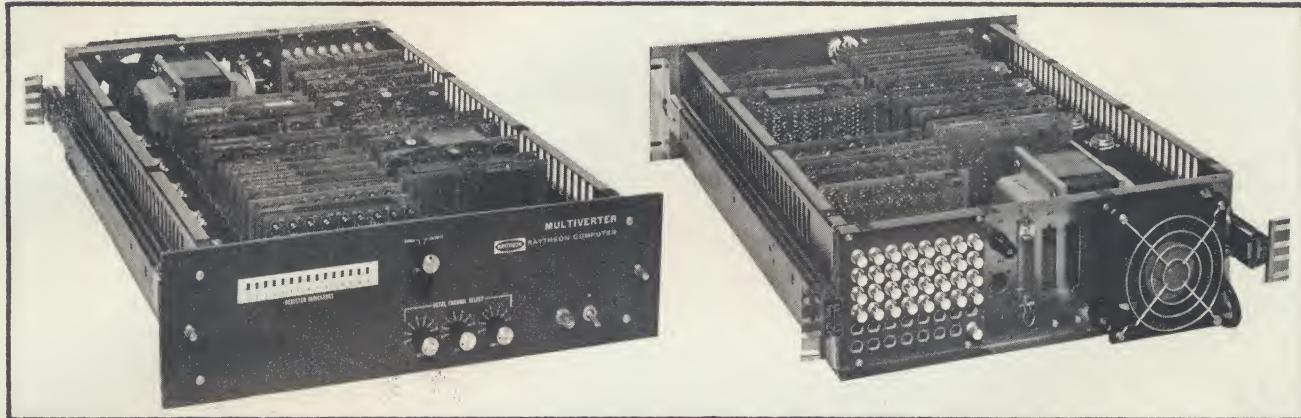
# Technical Bulletin

### GENERAL DESCRIPTION

The system described in this Bulletin is a standard Raytheon Computer Multiverter which has been modified to accept up to 48 differential analog input signals rather than the normal single ended inputs. The system is intended for applications where high speed and high accuracy measurements must be made on differential signals. This differential Multiverter system offers all of the flexibility of the standard system and at the same time offers an ideal solution for isolating grounds in a data acquisition system.

High common mode rejection (100 db) can be achieved on common mode voltages up to  $\pm 1$  volt. An overall input voltage of  $\pm 11$  volts can be accommodated ( $E_{Diff} + E_{CM}$ ). The differential Multiverter system can be supplied in any of the 17 configurations listed in Table 1.

This technical bulletin describes the primary functions and specifications of the differential "package" within the Multiverter. Complete information on the operation of the standard system is contained in Technical Brochure SP205A.



### SYSTEM SPECIFICATIONS

#### Analog Inputs

Input Range	$\pm 10$ VFS (Standard)
Input Impedance	100 meg. ohms (minimum) for selected or unselected channels
Source Impedance	1K ohm maximum for spec. performance
Aperture Time	50 nanoseconds maximum
Common Mode Voltage	$\pm 1$ volt maximum (1)
Common Mode Rejection	100 db at DC - 80 db at 400 cps
Crosstalk	80 db (2)
Maximum Voltage Overload	$\pm 100\%$ of Full Scale (3)
Channel Capacity	48 channels maximum (96 switches - 2 per channel)
Performance	
Throughput Rate	See Table No. 1
Linearity	0.01% $\pm 1/2$ LSB
Long Term Drift	0.02% for 30 days
Noise	1Mv. peak-to-peak maximum
Temperature Coefficient	15 ppm/ $^{\circ}$ C
Overall Accuracy	0.025% $\pm 1/2$ LSB worst case at 25 $^{\circ}$ C.

#### Digital Inputs/Outputs

Input Controls	Multiverter Start - Channel Address (8 lines) - Mode Select (2 lines)
Digital Outputs	Parallel Outputs (17 lines max.) Multiverter Busy - Frame Sync - Serial Output (2 lines)
Logic Levels	Binary "1" -6V or more negative Binary "0" zero volts (Positive Levels also available)
Temperature	
Operating Temperature Range	0 to 50 $^{\circ}$ C
Warm-up Time	10 minutes to rated accuracy
Cooling	Internal Muffin Fan
Temperature Coefficient	15 ppm/ $^{\circ}$ C
Mechanical	
Analog Inputs	BNC connectors standard (other types available)
Digital I/O (Mate)	Amphenol type 17-20500-1 or Cannon Type DD50P
Display	Amperex Indicators for ADC Register
Size	Width 19" (Slide mounted) Height 5 1/4" - Depth 22 1/8"
Weight	60 pounds (Typ.)
Power	105 to 125 VAC - 50 to 400 cps 125 VA (approx.)

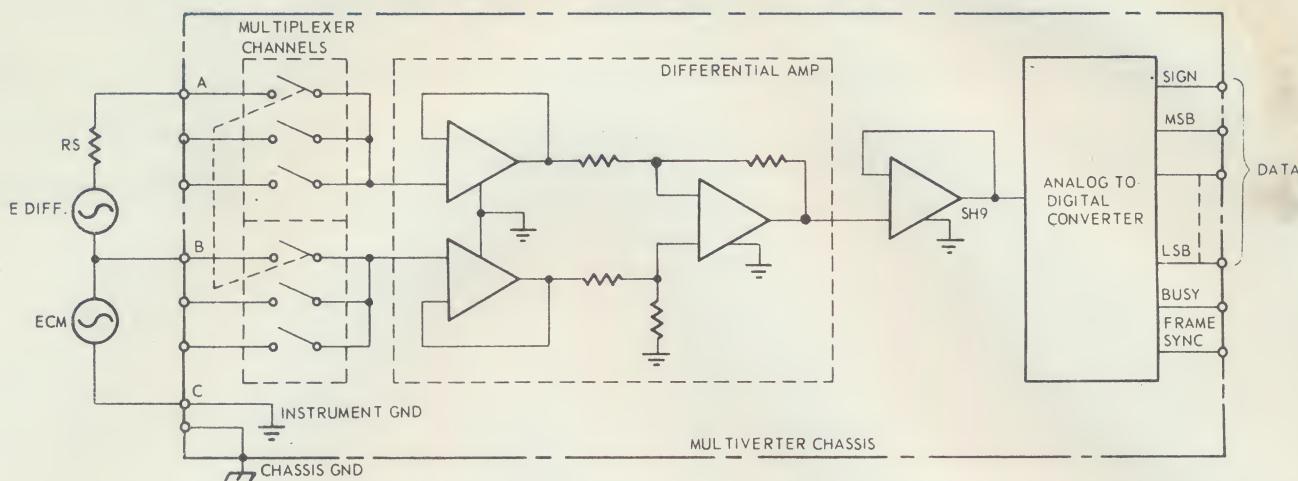
#### General Notes

1. The common mode voltage may exceed  $\pm 1$  volt as long as  $E_{Diff} + E_{CM}$  does not exceed  $\pm 11$  volts.
2. Crosstalk is measured as follows: A 400 cps full scale input voltage is applied through a 1000 ohm source impedance to all channels except the one being monitored. The 400 Hz noise is measured on the selected channel which has zero volts applied through a 1000 ohm source impedance.
3. No more than 2 channels can simultaneously be overloaded (by 100%) for the Multiverter to operate to rated specs.

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RAYTHEON



#### SYSTEM DESCRIPTION

Analog inputs are applied as shown above in Figure 1. The high side of the signal is applied to point A and the low side of the signal to point B. The common mode voltage return is to point C. Both the high and low side of each channel is switched into a high impedance potentiometric amplifier. These two signals are differentially

summed and then applied to the SH-9 sample and hold amplifier. The output of the SH-9 is connected into any of the A/D converters shown below.

The Multivertor system timing is adjusted to accommodate the extra settling time of the differential amplifier. The differential Multivertor operates exactly as described in SP205A, with the exception of the somewhat reduced throughput rates (Table No. 1).

Table No. 1, Analog-to-Digital Converters

Resolution	Model Number (Binary instruments)	Bit Rate	Nominal System Throughput **Rate
10 Bits *	ADC21-10B-B ADC23-10B-B	1.2 Microsec/bit 2.0 Microsec/bit	40KC 30KC
11 Bits *	ADC21-11B-B ADC23-11B-B	1.2 Microsec/bit 2.0 Microsec/bit	38KC 28KC
12 Bits *	ADC21-12B-B ADC23-12B-B ADC25-12B-B	1.2 Microsec/bit 2.0 Microsec/bit 3.5 Microsec/bit	36KC 26KC 18KC
13 Bits *	ADC22-13B-B ADC24-13B-B	2.0 Microsec/bit 3.5 Microsec/bit	25KC 17KC
14 Bits *	ADC22-14B-B ADC24-14B-B	2.0 Microsec/bit 3.5 Microsec/bit	24KC 16KC
15 Bits *	ADC20-15B-B ADC24-15B-B	2.0 Microsec/bit 3.5 Microsec/bit	22KC 15KC
BCD Instruments (8-4-2-1 Code)			
3 BCD Plus Sign	ADC22-13D-B ADC24-13D-B	2.0 Microsec/bit 3.5 Microsec/bit	25KC 17KC
4 BCD Plus Sign	ADC20-17D-B ADC24-17D-B	2.0 Microsec/bit 3.5 Microsec/bit	20KC 14KC

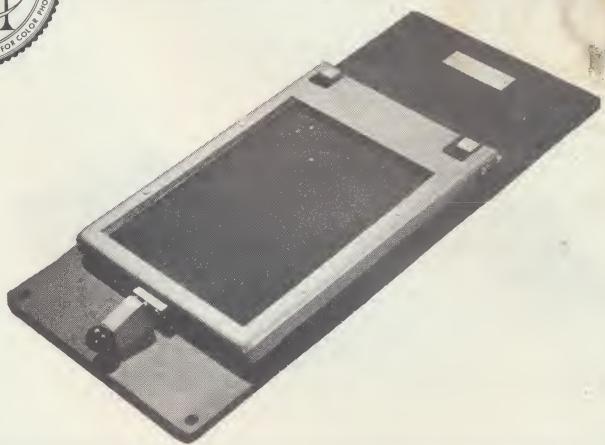
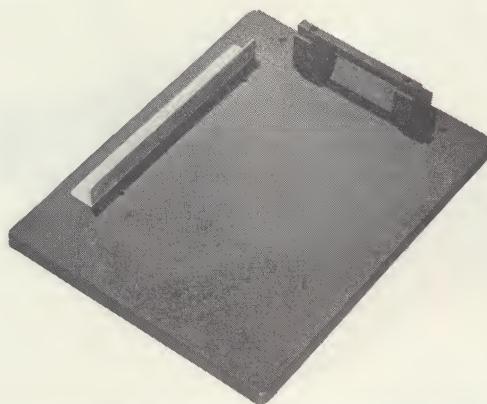
\*Includes Sign

\*\*Throughput Rate for entire Differential Multivertor System when using the A/D Converter shown.

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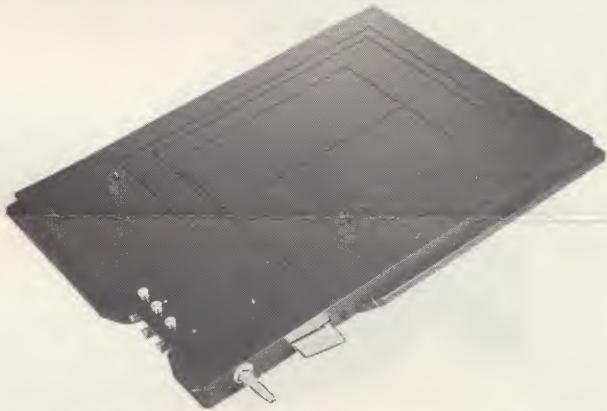
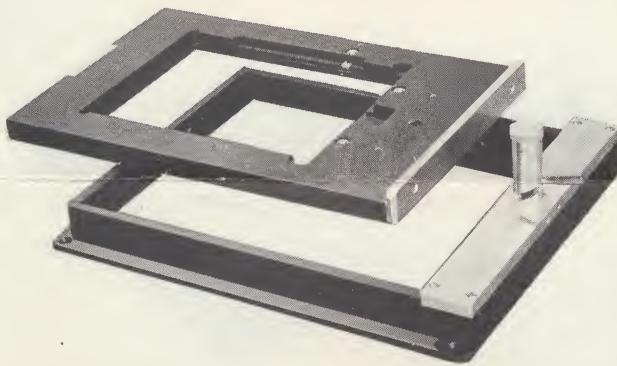


UNIT	PUNCH	SIZE	4 x 5 - 5 x 7 8 x 10	COST	\$18.00 \$19.50
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PUNCHES ONE SIXTEENTH INCH HOLES IN THE FILM MARGIN OUTSIDE PICTURE AREA. BAR IS PRESSED DOWN PUNCHING TWO HOLES AT THE SAME TIME. GUIDE ON THE SMALL PUNCH IS FASTENED IN EITHER POSITION BY TWO SCREWS. PIN GLASS (S X 7 - \$12.00) (8 X 10 - \$18.00) OR REGISTER STRIP (\$12.00) USED WITH PUNCH. REGISTER GLASS OR STRIP MATCHED TO SERIAL NUMBER ON PUNCH. PUNCHES AND ANVILS ARE HARDENED.

UNIT	MASK REGISTRATION PRINTER	SIZE	4 x 5 - 5 x 7	COST	\$72.00
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DESIGNED FOR MAKING ENLARGED SEPARATIONS FROM SMALL TRANSPARENCIES PROJECTED IN ENLARGER. PRINTER FASTENS TO EASEL. REGISTER PINS ON THREE INCH CENTERS ARE CEMENTED IN HINGED GLASS PLATE WHICH LOCKS ON TOP OF FOAM RUBBER PAD. EXPOSURE IS MADE THROUGH GLASS FROM THE TOP. MASKS ARE MADE THE SAME SIZE AS SEPARATIONS.

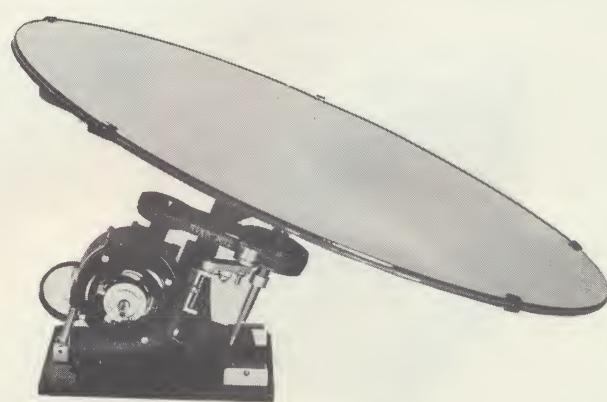
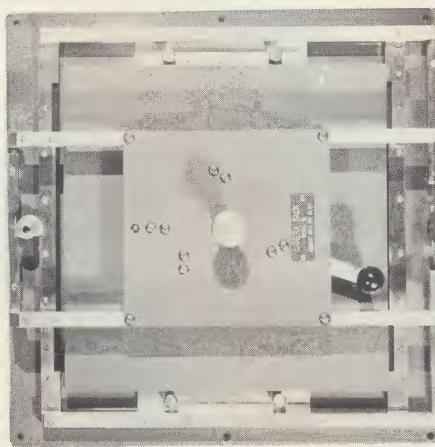


UNIT	PRECISION NEGATIVE CARRIER	SIZE	4 x 5 5 x 7 8 x 10 8 x 10	MODEL	OMEGA DURST ELWOOD SALTZMAN	COST	\$191.00 \$213.00 \$223.00 \$236.00
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CONSISTS OF TWO PARTS FOR ALL ENLARGERS EXCEPT SALTZMAN; THE BASE WITH LOCK WHICH FASTEN INTO ENLARGER, AND THE NEGATIVE CARRIER. THE CARRIER LOCKS FIRMLY TO THE BASE AND HAS ADJUSTABLE REGISTRATION PINS. PUNCHED REGISTERED SEPARATIONS CAN BE PROJECTED IN EXACT REGISTER. ENLARGER SHOULD BE BRACED TO ENSURE RIGIDITY.

UNIT	RETRACTABLE PIN VACUUM EASEL "T" SLOT BASE	SIZE	8 x 10/10 x 12 11 x 14 TO 16 x 20	SCREENE	11 x 14 17 1/2 x 22	COST	\$270.00 \$330.00 \$97.00
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FOR MAKING DIRECT REPRODUCED SEPARATIONS FROM TRANSPARENCIES. A COMPLETE SET OF REGISTRATION PINS FIT EASTMAN MATTEX PUNCH. FILM IS PLACED ON INSIDE PINS WHICH ARE RETRACTED AFTER FILM IS HELD BY VACUUM. SCREEN IS PLACED ON OUTSIDE PINS AND SECOND VACUUM CHANNEL OPENED. EXPOSURE IS MADE WITH SCREEN IN INTIMATE CONTACT WITH FILM. BASE FASTENS TO ENLARGER. VACUUM EASEL GL AMPS TO BASE AFTER POSITIONING.



UNIT	CAMERA BACK	SIZE	10 x 10	COST	\$337.00
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CAMERA BACK MOUNTS ON WALL INSIDE DARKROOM. CAMERA MOUNTS OUTSIDE. REGISTER PINS IN GLASS ONE SIXTEENTH INCH IN DIAMETER. GROUND GLASS FOR COMPOSING SWINGS TO THE RIGHT. TYPE "W" PLATEN SWINGS TO THE LEFT. FINE ADJUSTMENT ON GROUND GLASS POSITION FOR FOCUSING. PLATEN PRESS IS ADJUSTABLE. MASKS CAN BE MADE FROM COPY AND USED ON THE REGISTER PINS TO MAKE MASKED SEPARATIONS. CAMERA BACK CAN BE USED FOR MASKING DUPLICATE TRANSPARENCIES AND MAKING MULTIPLE DUPES ON ONE FILM BY THE USE OF CUT OUT MASKS.

UNIT	ROTATING MIRROR	SIZE	24" DIAMETER	COST	\$150.00
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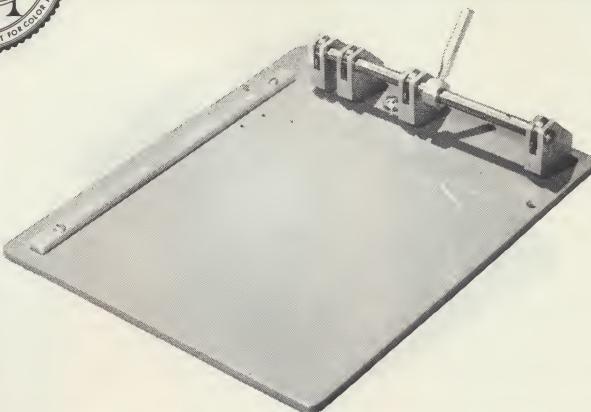
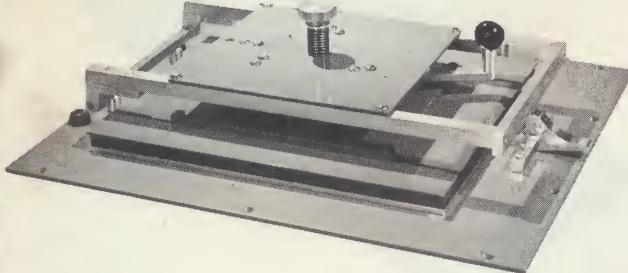
USED WITH THE PRINTING PLATEN AND THE LIGHT SOURCE. MIRROR IS ROTATED UNDER THE PLATEN IN THE TILTED POSITION FOR MAKING DIFFUSED MASKS. MIRROR IS DROPPED TO ZERO TILT POSITION (PICTURE) FOR SEPARATION EXPOSURES. IN THIS POSITION THE LIGHT IS DIRECTED TO THE FILM PERPENDICULAR TO THE FILM PLANE. MIRROR IS NOT ROTATED FOR SEPARATION EXPOSURES.

# Photographic mounting and registration devices.

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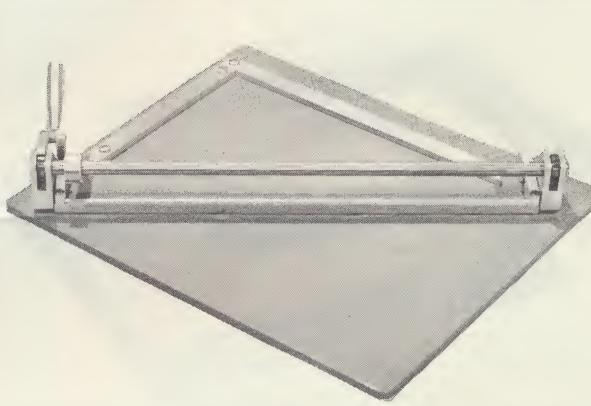
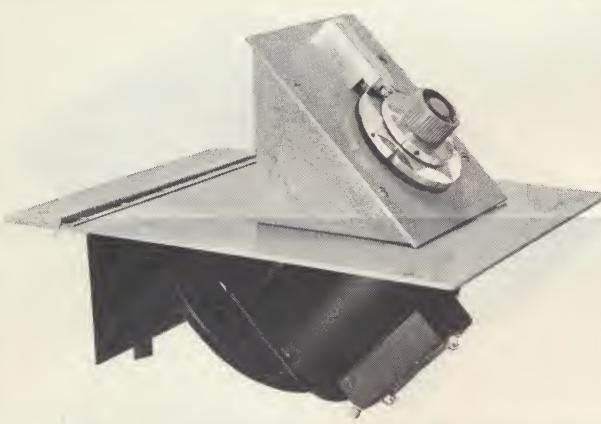


UNIT	PRINTING PLATEN	SIZE	8 x 10 10 x 12	COST	\$125.00 \$150.00
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DESIGNED TO ELIMINATE SLIDING BETWEEN FILMS POSITIONED ON REGISTER PINS DUE TO UNEVEN PRESSURE OF PLATEN. TWO PINS ONE SIXTEENTH INCH IN DIAMETER ARE CEMENTED IN PLATE GLASS. PUNCH NUMBER NECESSARY WHEN ORDERING REGISTRATION GLASS. PLATEN OPERATES ON A PNEUMATIC CYLINDER. PLATEN DOES NOT CONTACT FILM UNTIL LEVER IS OPERATED; PLATEN DROPS VERTICALLY TO MAKE CONTACT. PLATEN PRESSURE IS ADJUSTABLE. PLATEN MOUNTS ON BENCH TOP. EXPOSING LIGHT MUST BE LOCATED INSIDE BENCH.

UNIT	FILM PUNCH	SIZE	35 MM TO 5 x 7 35 MM TO 8 x 10 2 1/4 TO 8 x 10	COST	\$93.00 \$105.00 \$90.00
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PUNCHES TWO HOLES ONE SIXTEENTH INCH IN DIAMETER IN FILM MARGIN. GUIDES FOR CENTERING DIFFERENT SIZE FILMS. FILM SIZE CHANGES MUST BE COMPENSATED FOR BY CONTROLLING MOISTURE CONTENT OF FILM. WARM DRY AIR CAUSES FILM TO SHRINK; MOIST AIR OR STEAM CAUSES FILM TO EXPAND.

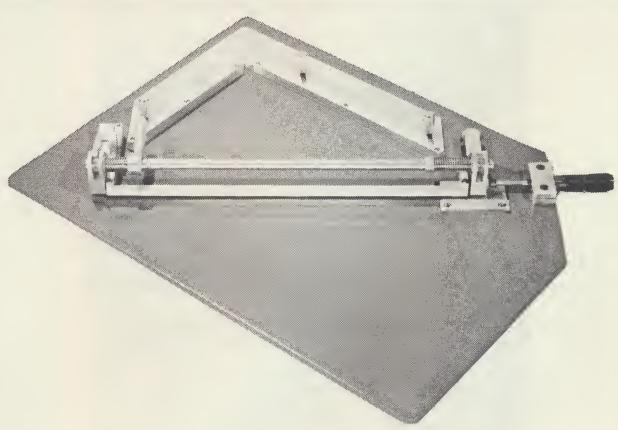
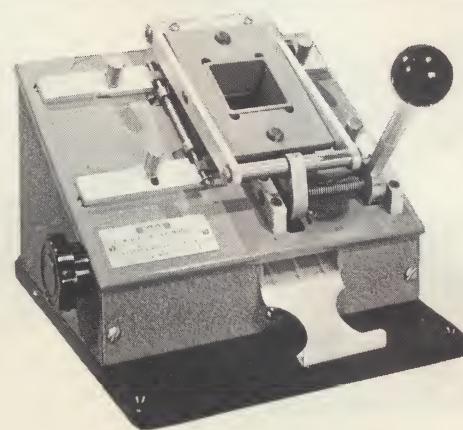


UNIT	EXPOSING LIGHT	SIZE	8 x 10 10 x 12 SEPARATIONS	COST	\$150.00
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USED IN CONJUNCTION WITH PRINTING PLATEN. LIGHT MOUNTS ON BENCH TOP. LIGHT IS DIRECTED TO A FIXED MIRROR UNDER THE PLATEN OR A ROTATING MIRROR FOR DIFFUSED MASKING. THREE SERIES VI GLASS MOUNTED FILTERS SUPPLIED; F, N, 47B. FILTERS SELECTED BY FILTER DISC; APERTURE SELECTED BY KNOB. HINGES OPEN TO REPLACE 75W #111 ENLARGING LAMP.

UNIT	DIAGONAL FILM PUNCH	SIZE	8 x 10 10 x 12	COST	\$135.00 \$150.00
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INCREASED ACCURACY OF REGISTRATION WHERE FILMS MUST BE USED FOR MULTIPLE EXPOSURES. FILM SIZE CHANGES MORE PRONOUNCED EXCEPT WHEN USED WITH STABLE BASE FILM DUE TO THE GREATER DISTANCE BETWEEN HOLES.



UNIT	FILM DIE CUTTER	SIZE	35 MM SQUARE SUPERSLIDE	COST	\$145.00 165.-
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FOR CUTTING SUPER SLIDES FROM 120, 620 AND 127 ROLL FILMS. LIGHT INSIDE; SLIDE VIEWED BEFORE CUTTING.

UNIT	MICROMETER FILM PUNCH	SIZE	8 x 10 10 x 12	COST	\$180.00
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PUNCH ADJUSTABLE PLUS OR MINUS FORTY THOUSANDTHS OF AN INCH FOR USE WHERE FILM SIZE CHANGES CANNOT BE COMPENSATED FOR BY USUAL METHODS. MUST BE USED IN CONJUNCTION WITH ADJUSTABLE PIN GLASS. FILM GUIDE ADJUSTABLE FOR 8 x 10 AND 10 x 12.